The OutREACCH
A quarterly report by Regional Approaches to Climate Change Pacific Northwest Agriculture

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www.reacchpna.org

Counting What Counts—Surveys and Baseline Data in REACCH

Sanford Eigenbrode, REACCH Project Director

Survey: def. To examine or look at comprehensively; to inspect carefully. We are conducting several kinds of surveys and collecting related data to understand the diverse elements of the cereal production systems in which REACCH is working. More so than most of our legacy projects, REACCH aims to incorporate multiple factors interacting across the entirety of wheat production systems of Central Washington, Northern Idaho and Northeastern Oregon. Survey data allow us to understand the system in new ways. Baselines are needed to measure changes through time, guide our research and provide information useful to stakeholders.

This issue of The OutREACCH contains seven short reports to provide samples what we are learning through survey activities. Katt Wolf, Troy White and Jodi Johnson-Maynard have surveyed over 1,400 K-12 teachers to learn their views on climate change and agriculture and whether these topics are included in classroom instruction in the region. J.D. Wulfhorst and Leigh Bernacchi provide a snapshot of their survey of the general public (1,300 participants) to assess views on climate and agriculture. Kate Painter, Hilary Donlan and Dennis Roe through their ongoing surveys of producers have been assessing production costs and returns for wheat across the region; in their report they provide an example of the comparisons they are making among our production zones. We are even doing surveys of ourselves as a project. David Meyer, as part of his assessment of the project, is using surveys of REACCH participants to learn how they are collaborating and how they view collaboration. John Antle, Laurie Houston and Jianhong Mu have used surveys of participants to help them as they guide our project in developing representative agricultural pathways (RAPs) for possible future scenarios of wheat production systems in the region. Jim Durfey surveyed local equipment features for adoption of new technology. Our surveys aren't just limited to human populations. For example, Brian Lamb and his team are measuring greenhouse gas emissions at different locations to allow us to understand current state of these emissions under different types of production systems and climate.

Other survey activities we don't have space for in this issue are examining insect pests like wireworms and aphids, beneficial insects and earthworms, pathogens, and weeds in wheat production systems. These other studies are making discoveries. For example, our biotic surveys have found an aphid species new to North America that is established in our wheat system, and wireworm surveys are delineating the distributions of different wireworm species, more than were known to be prevalent here. As another example, grower surveys are revealing increasing interest in newer fertilizer application technologies. Since all or most of our survey data are geospatial, we can create new syntheses of how factors differ and interact in different parts of the REACCH system.

In other words, surveys provide essential foundations for much of what we are doing in REACCH and allow us to be relevant to all of our producers.

REACCH team members gathered February 12-14 in Portland, OR for our 2nd annual meeting. For more information see *https://www.reacchpna.org/whatsnew/meetings/reacch-meeting-2013*. **Hold the date: March 5-7, 2014 in Richland, WA.**

A Comparison of Wheat Costs and Returns by Zone for 2011

Kate Painter, Hilary Donlon, and Dennis Roe

Based on an in-depth survey of 48 wheat growers chosen from various production regions across the Inland Pacific Northwest, net returns per acre for wheat production are highest in the annual cropping region (Zone 1), at $176 per acre (Figure 1). This region is characterized by annual precipitation of over 18 inches. In the transition region, in which land is fallowed one year in three (Zone 2), net returns per acre are slightly lower, at $159 per acre. Precipitation in this zone is typically 15 to 18 inches per year. In the wheat/fallow region (Zone 3), with precipitation of less than 15 inches per year, net returns per acre for wheat production are $95 per acre. These costs include summer fallow expenses, but revenue is only received every other year in this region. Per acre net returns are lowest for irrigated wheat production (Zone 4), at $69 per acre.

In-depth personal interviews have been conducted with each wheat producer in this four-year study. Wheat production involves not only standard inputs like seed, fertilizer, and pesticides but also requires costly investments in machinery. Multiyear investments are a special category of farm costs, and require detailed information including repair costs and estimates of machinery life and salvage values. Land costs are estimated for each grower using a formula based on typical rental rates for this region. Labor costs for machinery operation are based on a standard rate of $20 per hour. A small management fee, 5% of gross revenue, is also included.

Total costs per bushel of wheat were lowest for growers in Zone 1 at $4.96, but only slightly higher at $5.08 for Zone 2 growers (Figure 2). Zone 3 growers in the wheat/fallow region had higher total production costs of $5.51 per bushel, while costs in the irrigated region, Zone 4, were 19% higher at $6.55 per bu. Although irrigated wheat production has the highest yield, averaging 152 bu per acre, the increase in production costs outweighs its production advantage when compared to dryland wheat producers in this study (Figure 3). Yields averaged 88 bu/ac in Zone 1, 83 bu/ac in Zone 2, and 63 bu/ac in Zone 3 (Figure 3).

In addition to detailed agronomic and economic data, participating growers answer questions regarding technology use, pests, university Extension services, demographics, and more. REACCH scientists are also documenting insect pests and earthworm populations at these growers' farms. Details of each farming operation are recorded in these surveys, such as timing of tillage operations, planting and harvesting dates, and pest outbreaks. This holistic approach will help scientists understand agroecological impacts and trade-offs of different farming practices by zone across this region.

These growers serve as a critical source of primary data on this project. Documenting interregional differences will help others understand the complexity of farming operations as well as the unique characteristics of different cropping systems in place across this varied region.

Figure 1. Average net returns by zone, 2011 ($/ac)

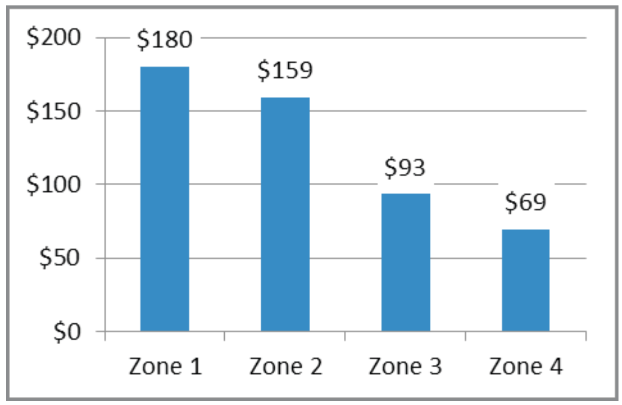


Figure 2. Average cost of production by zone, 2011 ($/bu)

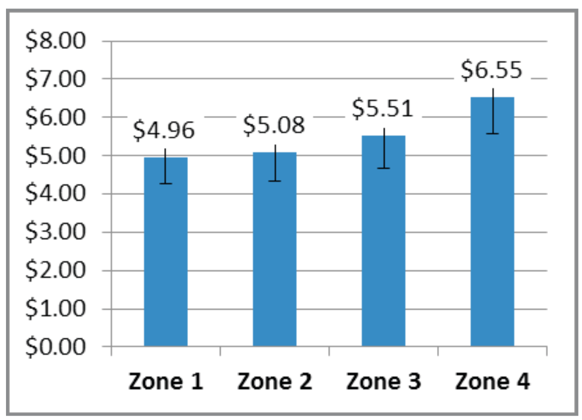


Figure 3.

Zone	Annual precipation
1	Over 18 inches
2	15 to 18 inches
3	Less than 15 inches
4	Irrigated

Public Perceptions of Climate Change and Risk to Food Availability

J.D. Wulfhorst, Leigh Bernacchi, Stephanie Kane, and Monica Reyna

One of the least studied aspects of climate change remains agricultural impacts from changes in not only temperature and rainfall, but also pests, weeds, and other risks. While scientists and the agricultural industry begin to project those effects, do we know how the general public perceives agriculture and climate change in our region?

For example, does the general public perceive risk of crop failure in the Pacific Northwest from climate change? Or is the risk of a food shortage greater as a result of climate change? Insights to these questions and more are vital in order to develop socially relevant strategies as the climate affects the urban and rural communities where we live.

We found in our telephone survey of 1,300 residents of Oregon, Washington and Idaho the following:

- Most people perceive either no difference or a higher risk of food shortages in the future.
- As one might suspect, those who are less concerned about climate change also perceive less risk for future food shortages, and vice versa; Greater concern about climate change is more common among those who perceive a greater risk of food shortages (Figure 1).
- Among those feeling very informed about climate change, there is also a tendency to perceive much higher risk to future crop failures (Figure 2).
- Finally, the general public distinguishes between the two risks of food shortage and crop failure: we found a wider range of those who perceive crop failure risk also perceive a risk of food shortage.

Together, these results suggest that while residents in the region may or may not understand all the complexities of climate change effects, many do perceive risk related to the agricultural systems and food security in the region. Look for more interesting results from the social science portion of REACCH and our collaborations with the rest of the team in the near future.

Figure 1. A comparison of concern for climate and perception of risk of food shortage

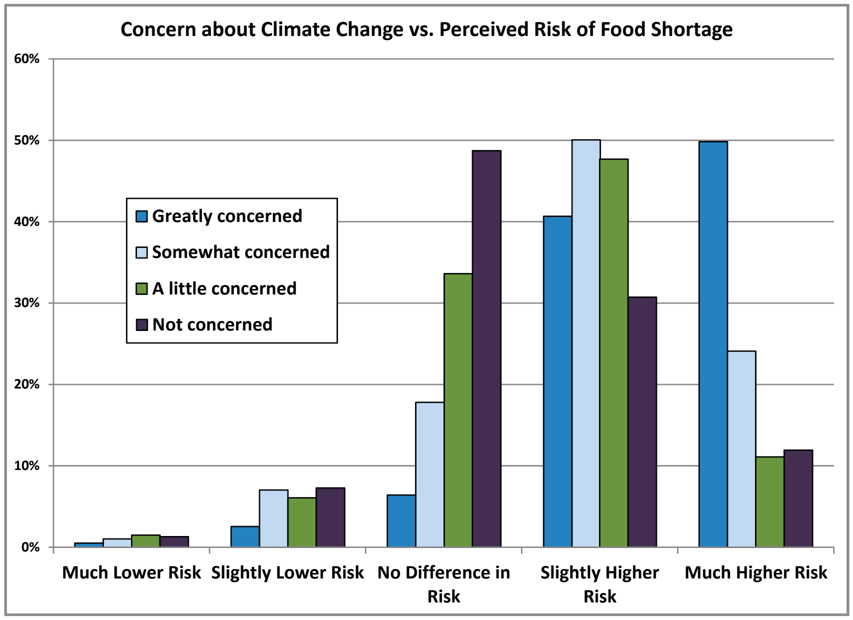
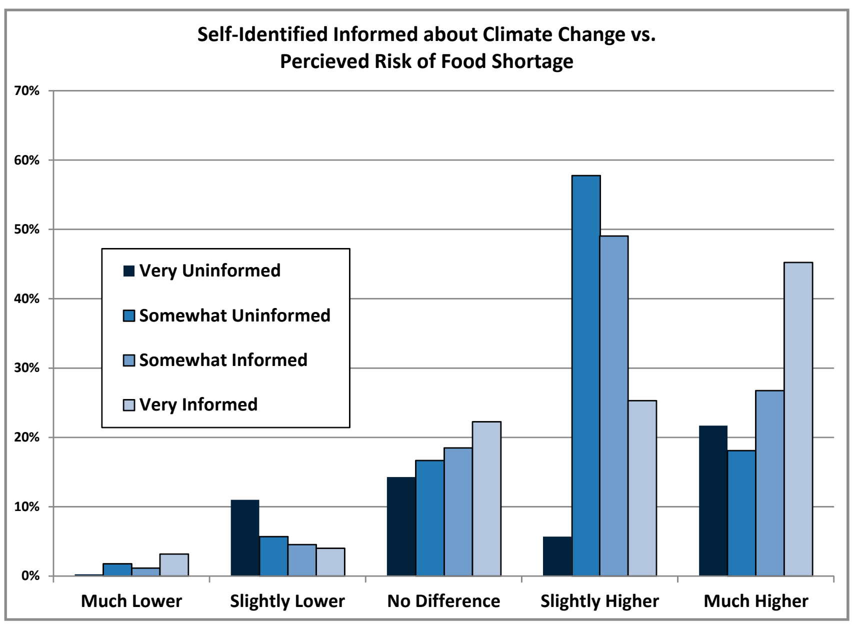


Figure 2. A comparison of people who self-identify as informed about climate change and the risk of food shortage

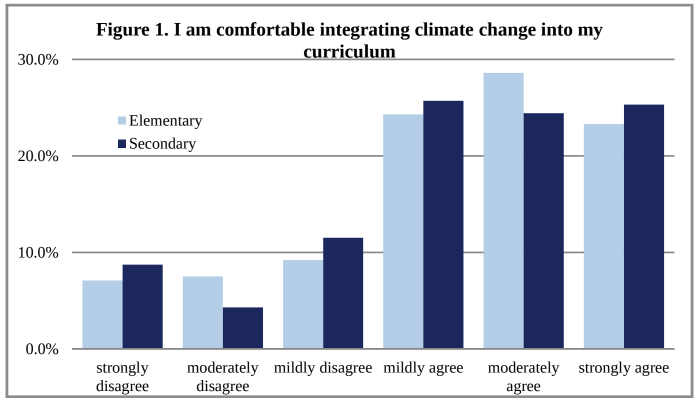


Teachers in the Inland Pacific Northwest and Climate Change

Peter Troy White and Kat Wolf

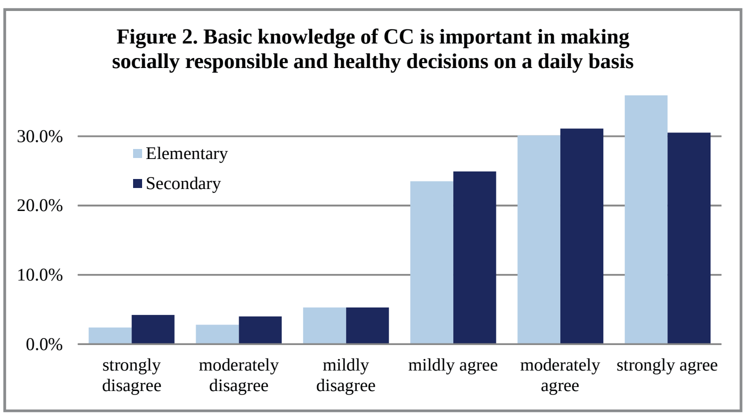
Teachers were surveyed across the REACCH study region. This survey yielded over 1,400 responses with a near even distribution between elementary (K-6) and secondary (7-12) schools. From this survey researchers are working to determine the teacher's perceptions of climate change issues, as well as to determine where climate change (CC) instruction occurs in the schools.

Figure 1 shows teacher comfort levels with integrating CC issues in their classrooms. Overall, teachers agreed they were willing to integrate CC into their classes at both the secondary and elementary levels.



One of the other key questions we asked was how important teachers felt understanding CC was to making socially responsible and healthy decisions.

Again teachers tended to agree, even more than were comfortable with CC integration, that basic knowledge of CC is important (Figure 2).



Secondary teachers were also asked how often CC instruction took place in their classrooms. Responses suggest that while teachers feel CC is important (Figure 2), few spend more than 2-3 classes a year discussing it, and nearly 20.0% of the teachers reported never teaching CC at all (Figure 3).

Further analysis of survey results are being conducted to determine how REACCH can better assist teachers with including CC into their classes. This summer the second annual teacher in-service will be held to share resources and classroom ideas with teachers from across the region.

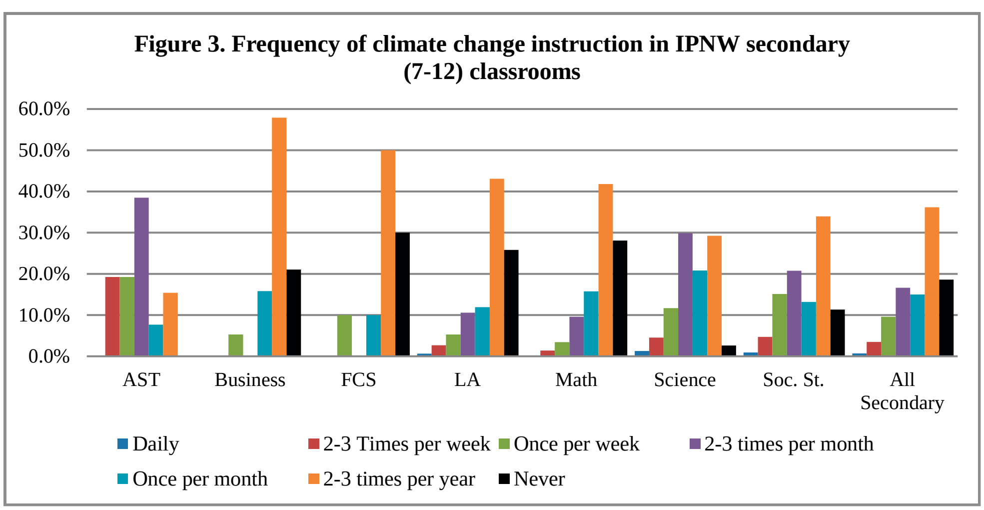


Table abbreviations: AST=Agriculture, FCS=Family & Consumer Sciences, LA=Language Arts.


Response Clicker


Response Clicker


Response Clicker

Clickers regarding commercial farm size assumptions

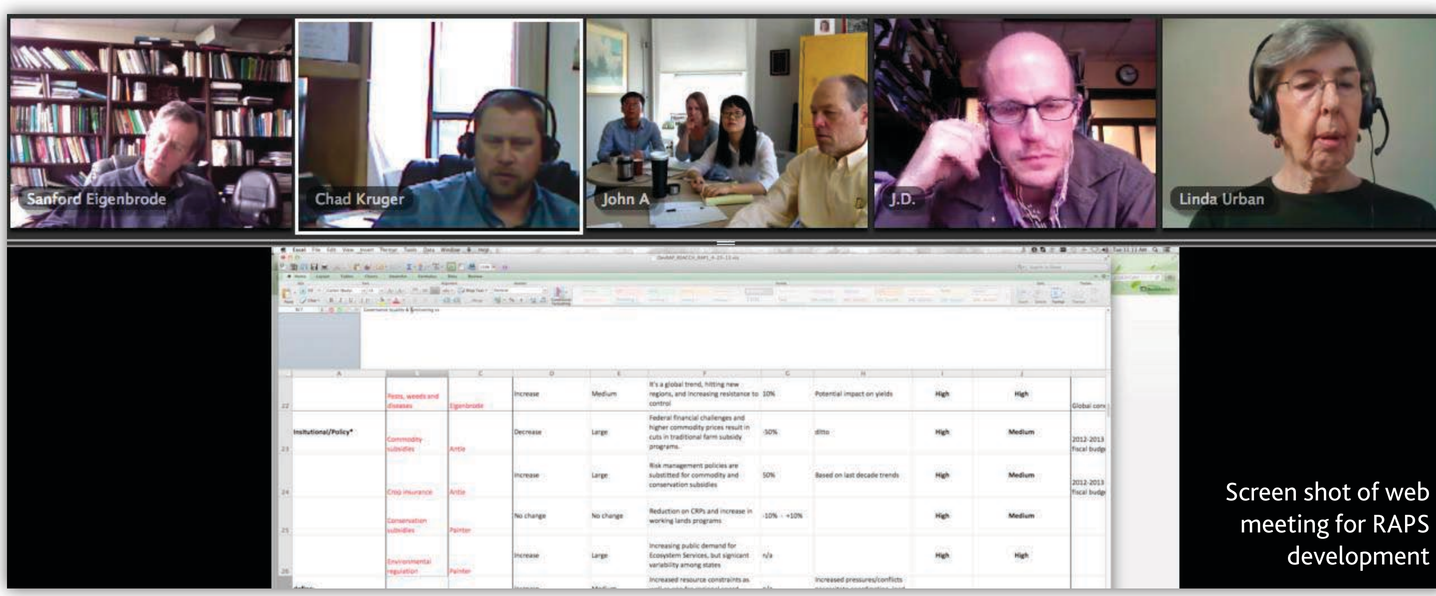
Regional Agricultural Pathways and Scenarios (RAPS)

John Antle, Laurie Houston, and Jianhong Mu

Representative Agricultural Pathways and Scenarios (RAPS) are projections of plausible future bio-physical and socio-economic conditions used to carry out climate impact assessments for agriculture. RAPS is a new, more systematic approach to pathway and scenario development for agricultural system modeling being developed by the Agricultural Model Inter-Comparison and Improvement Project (AgMIP), a global research consortium. John Antle, the leader of the REACCH modeling Framework team, is also leading the development of RAPS for AgMIP. RAPS will be developed for the REACCH region and used to assess impacts of climate change and adaptations of wheat-based systems in the Pacific Northwest region. To develop RAPS for REACCH, project scientists and other experts with knowledge of the region's agricultural systems are working together through a step-wise program designed to guide this process and to record and document the information used to create RAPS. When completed, the RAPs will be used by the modeling team to help design computer simulations for climate change impacts and how technological innovations will help farmers adapt to changing environmental and economic conditions.

Members from REACCH Objective teams 1, 3, 4 and 5 (Modeling Framework, Cropping Systems, Economic and Social, and Biotic Factors) have been using this method to develop RAPS for the REACCH project. In January they met to identify variables and drivers that would be important for scenario development, and an outline of the first scenario was developed. During a special session at the 2nd annual REACCH meeting, John Antle and Chad Kruger presented the RAPS process and obtained stakeholder input on various aspects of the RAP that was developed. Participants in the meeting used clickers to evaluate the variables the scientific team had identified for a "business as usual" future pathway. Via this process the researchers were able to obtain valuable insights about issues such as pests and the potential of improved yields through new breeding technologies. Also, cases were identified where additional expert input was needed to project the possible direction and magnitude of changes in important variables, such as genetic improvements in wheat varieties.

Objective teams 1, 3, 4 and 5 continue to collaborate to refine plausible scenarios incorporating inputs from the Annual Meeting responses and other experts, and documenting and validating various decisions along the way. The teams recently had a web-based meeting to discuss the next steps in the process and will have at least three more meetings to complete Scenario 1 and develop at least two more RAPS to represent a range of alternative futures for the REACCH region.



Screen shot of web meeting for RAPS development

Adoption of Precision Agriculture Technologies in the Palouse Region

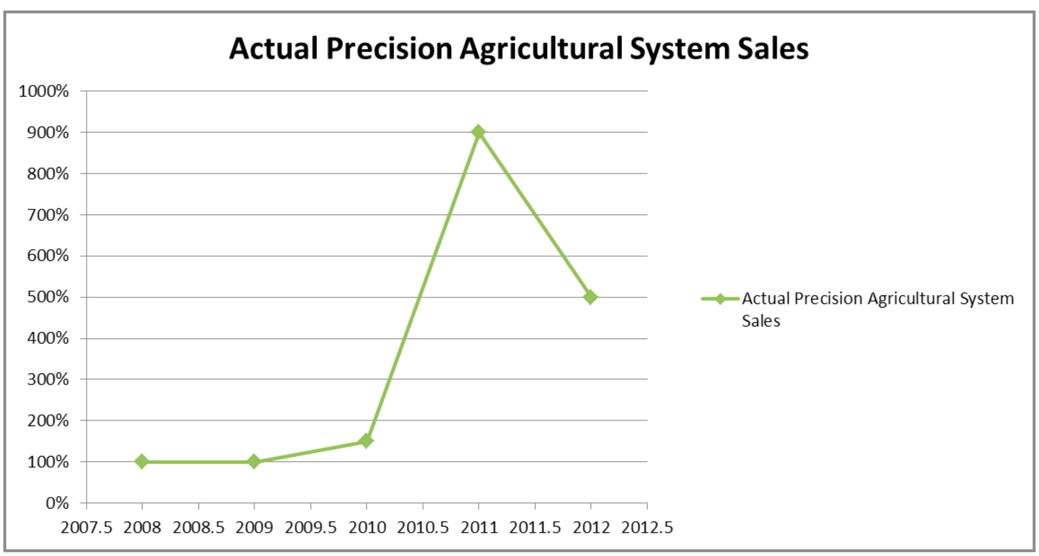
James Durfey

Adoption of technology in agriculture is one of the key fundamental elements for success. The rate of adoption and implementation of technologies is a function of the producer's realistic return on investment (ROI). Technologies are wide spread, varying from adoption of marketing strategies, new genetic traits of plant varieties, changes in cultural practices to the adoption of precision agriculture (PA) principles. Depending on the financial position of each producer, investment in the growing crop and willingness to invest in new technologies, all affect the rate of adoption.

Four local equipment dealerships (2 John Deere & 2 Case/IH), and several generic agricultural machinery and farm chemical dealers were contacted to determine the adoption of PA technologies. These businesses represent the largest block of equipment sales in the Palouse region, extending into Adams county, with each of these businesses representing the largest percentage of PA technologies currently available to U.S. agriculture. These systems vary from autotrac, swath and section control, variable rate to yield monitors.

Actual sales numbers related to the adoption of PA were used to determine rate of growth. These sales numbers include PA systems adopted for road-side vegetation management of trucks for state, county and Forest Service contract applications. Growth in demand for road-side management and agricultural field units has been a consistent 5-10% annually from 2007-2011. A 33% growth in sales was noted in 2012. The bulk of commercial contract (state, county and FS) have stabilized with Ag sales growing quickly. Summary from another private business sector is showing the following sales.

2009-2010: 50%
2010-2011: 60%
2011-2012: down 30% mostly due to new tractors, sprayers and combines are now available with wiring harness. This allows the grower to purchase the PA unit needed and attach it to the cab and go to work.



Sales within the John Deere Dealership regionally are as follows:

2009-2010: 39%
2010-2011: 36%
2011-2012: 50%

Further breakdown by county of adoption of PA technologies.

Whitman: 40%
Garfield: 24%
Lincoln: 16%
Adams: 11%
Other: 9%

Most of these sales are for Guidance Incorporating Rate Controllers, indicating we are well on the way for adoption. Yield monitoring systems are not as critical as the need for rate controllers for chemicals and fertilizers.

The above graph shows a dip but this represents a recent change in dealership ownership and client base. Washington State University is experiencing a demand from the farm chemical, plant health food business for graduates who are educated in PA software and have the ability to make spatial determination of cropping system needs. Many of these positions will go unfilled in 2013.

Greenhouse Gas Monitoring

Team: Brian Lamb (Lead), Ryan Boyle, Erin Brooks, David Brown, Jackie Chi, Jan Eitel, Dave Huggins, Kirill Kostyanosvky, Chad Kruger, Troy Magney, Jason Morrow, Patrick O'Keefe, Bill Pan, Shelley Pressley, Richard Rupp, Brenton Sharratt, Claudio Stockle, Lee Vierling, Sarah Waldo

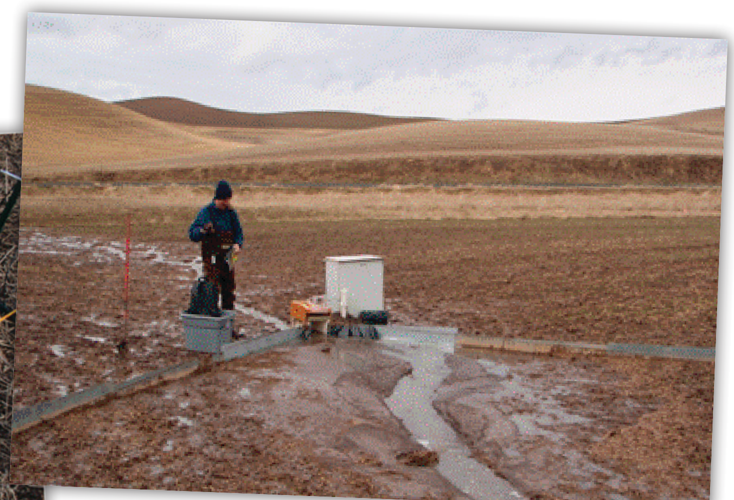
Establishing a Baseline

One of our monitoring goals is to assess the current effects of wheat cropping systems on carbon storage and greenhouse gas emissions to the atmosphere, while a second goal is to assess how changes in management strategies in different regions within the Northwest affect carbon storage and greenhouse gas losses. To meet these goals, we have deployed a number of measurement stations where we measure the amount of carbon dioxide exchanged between the atmosphere and crops and soils. Periodically, we also measure the amount of nitrous oxide (N2O), an important greenhouse gas, lost from the soils. These "flux tower" sites (see the photo below) are in a pair of conventional-till and no-till sites near Pullman, on a conventional-till site in a higher rainfall zone outside of Moscow, and in a wheat/fallow rotation site near Lind. We are also using surface chambers to measure carbon dioxide and N2O emissions from soils at the flux site and at other locations in the domain. Results from these different types of measurements will be combined with new, novel remote sensing methods to better define carbon storage at the field scale. At the same time, for some locations, water erosion measurements are helping to determine the amount of carbon and nitrogen lost due to runoff. Finally, for the Lind site, we are also measuring carbon and nitrogen losses due to wind erosion. The data from all of these measurements will be used to test crop models and to use the models to make region-wide estimates of carbon storage and greenhouse gas losses.

We'll provide the following deliverables:

- Baseline measurements of the greenhouse gases that current farming practices emit, how much water and nitrogen these practices use and how much carbon they sequester in each of the field sites
- An assessment of how changes in current crop management practices might change carbon sequestration and greenhouse gas emissions
- Region-wide estimates of how much carbon the soil and crops store and how much nitrous oxide the soil emits under current and projected weather conditions
- An analysis of how much carbon dioxide and nitrous oxide are released into the atmosphere because of water and wind eroding the soil

The REACCH monitoring team is made up of researchers from WSU and UI working to collect and analyze greenhouse gas data thru the use of flux towers, surface enclosure chambers, remote sensing, and wind and water erosion sampling.



Surveys Help Get The Academic "Soup" Just Right

David Meyer, REACCH-PNA Project Evaluator

Highlighted Statement: "Sharing responsibility for a complex problem can lead to little real activity or disorganized hustle and bustle. So how do you come up with solutions that are beyond the skills of any one person?"

American newspaperman, H.L. Mencken is credited with the saying: "For every complex problem, there is an answer that is clear, simple—and wrong." How to mitigate and adapt to climate change in Pacific Northwest agriculture certainly fits Mencken's description of a complex problem.

There are a host of complex missions like the REACCH-PNA project, like making the technology needed to put a man on the moon, providing aid after a large natural disaster, or finding better treatments for cancer. Complex missions like these don't have a single expert with "the answer" who has total project authority. And giving complete control to single person is risky because that person may overlook a key ingredient or insist on a wrong addition.

But sharing leadership creates a big problem: too many cooks in the kitchen. Individual "cooks" might insist that their own pet project is the highest priority. Other "cooks" might slack off because no one is telling them what to do. Sharing responsibility for a complex problem can lead to little real activity or disorganized hustle and bustle. So how do you come up with solutions that are beyond the skills of any one person?

Surveys are used across the REACCH-PNA project to understand the outside environment. But survey feedback is also an important way to look within the project team and make sure all the right ingredients are included. Results from these internal surveys give everyone involved in the REACCH project a way to "taste the soup" and recognize important opportunities and challenges. This survey feedback can also be used to identify the management practices needed to keep everyone on track and moving in the same direction.

I use three surveys to help REACCH-PNA collaborators work more effectively together: an option survey (this includes items measuring trust between collaborators, impacts on productivity, and attitudes toward collaboration), a social network survey that helps show who is working with whom across the project, and a survey designed to capture important management ideas from across all participants. This last survey asks three open-ended questions: what's working, what needs to be changed, and what you do think everyone on the project needs to hear.

The last survey is a good example of how to orchestrate all the "cooks in the kitchen." I review all comments and categorize them into themes. I then write a report prioritizing the themes based on how often they are mentioned in the open-ended comments. The report is sent to everyone attending the annual REACCH-PNA meeting for review. During our face-to-face discussions at the annual meeting, participants can agree on specific actions we can take to improve the project and address our shortcomings based on ideas collected across all participants. Climate change adaptation and mitigation is a problem without a simple solution, but survey feedback helps REACCH-PNA look within itself to help get the academic "soup" just right.

Meet Our New Team Members

Kathryn Bonzo, Education Coordinator

As a K-12 teacher for the past twenty years, it is so interesting to be part of creating an interactive and collaborative model that allows students and their teachers to utilize cutting edge thinking and research. When exposed to real scientists doing real work around an issue, kids get excited and want to know more and how take action themselves; it helps to move their thinking about the future into the future. There is nothing better than well-informed, deep thinking, and excited kids to get parents and communities motivated and mobilized.

Kristy Borrelli, Extension Specialist

Hi everyone! I am Kristy Borrelli and I was recently hired as the REACCH Extension Specialist, and will be located at the UI, in Moscow. I am originally from Upstate NY where I grew up on a small family farm. I moved to Washington State in 2005 and completed my graduate degrees in Soil Fertility at WSU, in Pullman. The focus of my research and education has been on diversifying agricultural systems to manage soil fertility, plant nutrients and to maintain soil health and environmental quality. As the Extension Specialist, my goal is to positively impact local agricultural systems by collaborating with regional growers and providing them with outreach materials for environmentally sustainable farming practices that are also economically viable. I am also very interested in educating life-long learners of all ages, and hope to work with team members to integrate practical extension outreach-based learning with traditional classroom styles. I believe this approach to learning can enhance overall understanding of agriculture while keeping people involved in their local communities. I am excited for the extensive opportunities within the REACCH program that will allow me to engage in both of these interests. I now call the Pacific Northwest home and am looking forward to working with all of you, and continuing to explore the region through REACCH activities.

Join REACCH team members at several field days around the region to learn more about our dryland farming research

June 11—Pendleton, OR Field Day
contact Stephen Machado, 541-278-4416

June 12—Moro Field Day
contact Stephen Machado 541-278-4416

June 13—WSU Lind Field Day
contact Aaron Esser, 509-659-3210

June 18—Tammany (Lewiston) Field Day
contact Doug Finkelnburg, 208-799-3096

June 20—UI Weed Field Tour
contact Don Thill, 208-885-6214

June 25—Prairie Area Crop and Conservation
(Nezperce, ID) contact Ken Hart, 208-937-2311

June 27—Cook Farm Field Day
contact Dave Huggins, 509-335-3379

July 9—UI Parker Plant Science Farm Field Day
contact Don Thill, 208-885-6214

July 11—Spillman Farm Field Day
contact Dave Uberaqua, 509-335-3081

Check out our updated REACCH website
reacchpna.org
You will find new information on our research, team members, and upcoming events.

Check out 32 speed science presentations and other activities from our annual meeting *https://www.reacchpna.org/whatsnew/meetings/reacch-meeting-2013*.

SAVE THE DATE!!
The third annual REACCH conference will be held at the Red Lion Inn in Richland, WA March 5-7, 2014. Watch the website for information on hotel reservations, registration and more.

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University of Idaho
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National Institute of Food and Agriculture

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